Biodiversity Conservation Guide

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Welcome.

Agricultural producers care deeply for the land on which they live and from which they make their living. For many producers, caring for the land includes a special interest in wildlife and natural areas on their property. This guide's objectives are to: help you to learn more about the benefits that biological diversity provides to your farm or ranch; and help you identify what you're already doing and what else you can do to conserve biodiversity.

The guide begins by defining biodiversity and explaining its importance to agricultural producers and to our world. In the next section, the guide explains six basic principles of biodiversity conservation and, for each principle, lists supporting actions. These general principles and actions can be adapted to suit your own situation. If you farm or ranch in ways that are guided by these six principles, then you likely already know a great deal about your land and its ecological characteristics – about how living things interact with and respond to each other and their physical environment.

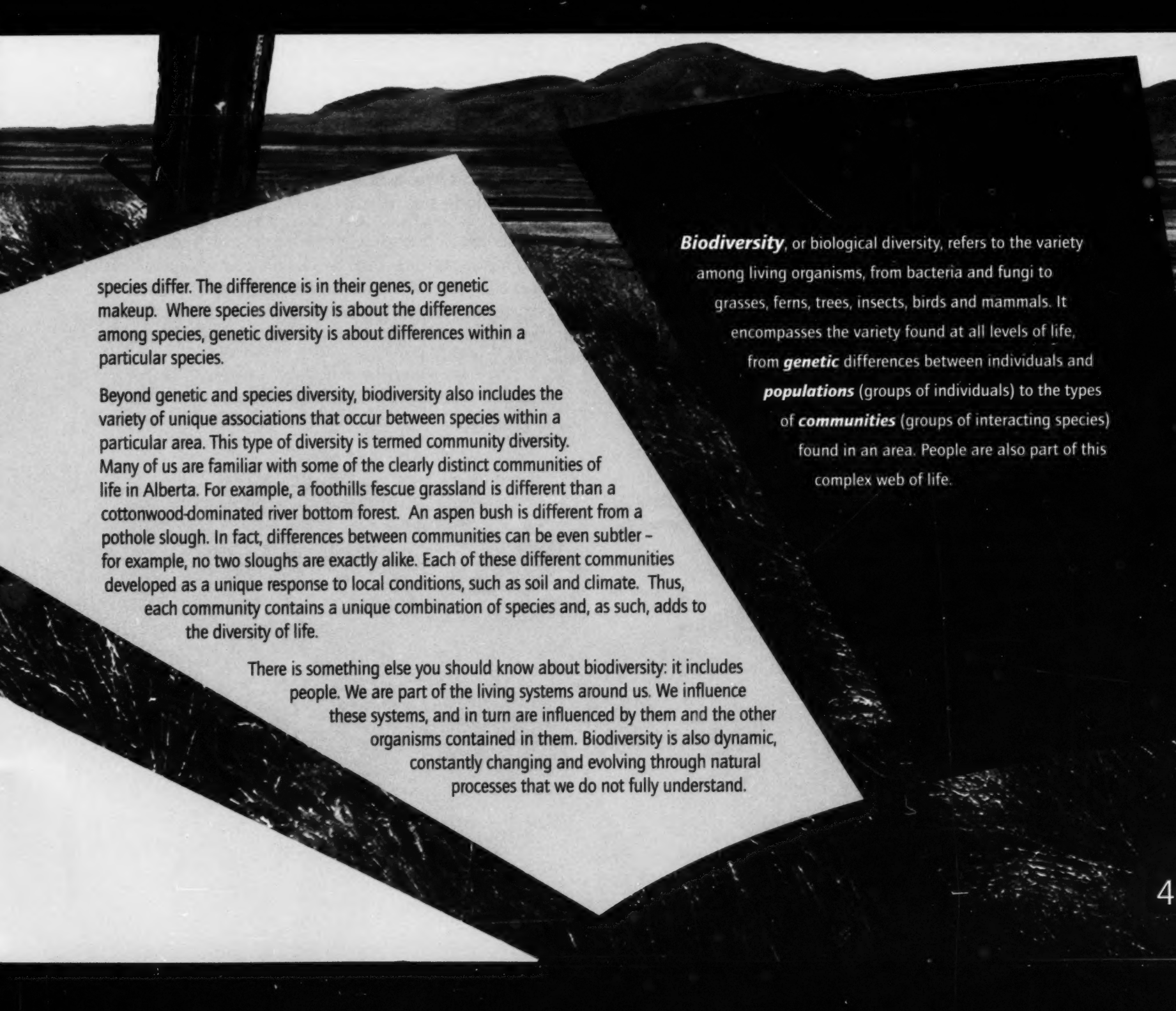
The guide concludes with information to help you take action to conserve biodiversity. It outlines the steps in developing and implementing a biodiversity conservation plan. And it lists agencies that provide financial/technical assistance to Alberta farmers and ranchers for biodiversity conservation.

Your actions can make a difference.

What is Biodiversity?

At first glance it appears simple – biodiversity equals biological diversity, or the great number of ways living things can differ. It is easiest to imagine when you think of all the different kinds (or species) of plants and animals there are, from big to small. Species diversity includes large grazing animals like bison and elk foraging in grassland, to microscopic fungi and bacteria breaking down organic matter in soil, and everything in between.

Biodiversity also refers to the degree to which individuals of a species differ from one another. Just as no person is exactly the same as another, individuals of a particular



Biodiversity, or biological diversity, refers to the variety among living organisms, from bacteria and fungi to grasses, ferns, trees, insects, birds and mammals. It encompasses the variety found at all levels of life, from ***genetic*** differences between individuals and ***populations*** (groups of individuals) to the types of ***communities*** (groups of interacting species) found in an area. People are also part of this complex web of life.

species differ. The difference is in their genes, or genetic makeup. Where species diversity is about the differences among species, genetic diversity is about differences within a particular species.

Beyond genetic and species diversity, biodiversity also includes the variety of unique associations that occur between species within a particular area. This type of diversity is termed community diversity. Many of us are familiar with some of the clearly distinct communities of life in Alberta. For example, a foothills fescue grassland is different than a cottonwood-dominated river bottom forest. An aspen bush is different from a pothole slough. In fact, differences between communities can be even subtler – for example, no two sloughs are exactly alike. Each of these different communities developed as a unique response to local conditions, such as soil and climate. Thus, each community contains a unique combination of species and, as such, adds to the diversity of life.

There is something else you should know about biodiversity: it includes people. We are part of the living systems around us. We influence these systems, and in turn are influenced by them and the other organisms contained in them. Biodiversity is also dynamic, constantly changing and evolving through natural processes that we do not fully understand.

Biodiversity and Agricultural Landscapes

Agricultural areas are filled with biological diversity. Take a moment to think about the diverse, complex ecosystem processes continually going on around us. Soil bacteria are composting stubble and other dead plant material and enriching the soil. Natural predators like birds and bats are limiting insect pest outbreaks and reducing the need for pesticides. Wetlands are collecting runoff and replenishing groundwater that tops up water wells. Plants are removing carbon dioxide from the air we've exhaled, and using it to build plant material while also producing the oxygen we need for our next breath.

Interestingly, about 95% of all living species are hidden from view in the soil, where life-forms range from worms and ants to microscopic mites, nematodes and single-celled organisms. These tiny life forms play a huge role in agricultural productivity. For instance, it has been estimated that the amount of plant material consumed by soil roundworms can be up to three times greater than that consumed by cattle in the mixed-grass prairies!

As it turns out, above ground biodiversity generally reflects below ground diversity – that is, the more diverse the plants and animals living above the soil, the more diverse will be the life in the soil.

The most biologically diverse ecosystems are generally those least altered by human activities. Areas like native grasslands, native bush, uncultivated fencelines and riparian areas (e.g., sloughs, creeks, river bottoms) are biodiversity "storehouses" benefiting the entire landscape. Because of this, biodiversity conservation tends to focus on native areas and their management.

Ecosystem

refers to a community of organisms living and functioning together in a given area.

An ecosystem can be any size. A farm is an ecosystem. A ranch is an ecosystem. There is an ecosystem in a drop of water, and the entire world can be thought of as an ecosystem.

Soils contain an incredible diversity of life.

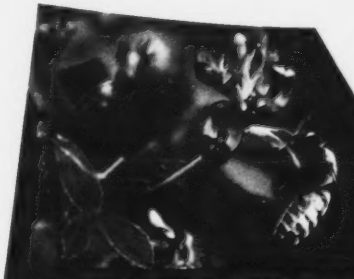
Essential Benefits to Farms and Ranches

Biodiversity and its many interactions are an integral part of agriculture's productivity and sustainability. Generally, the more diversity in life forms present on your farm or ranch, the greater the benefits you can realize now and in the future.

Here are some examples of the benefits to agriculture that result from managing for increased biodiversity:

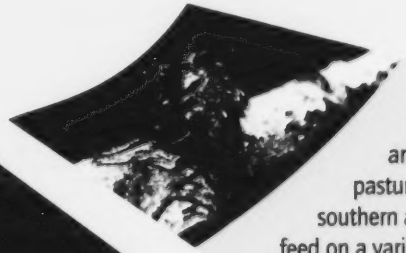
- Greater biodiversity can buffer against year-to-year variability in productivity. Systems rich in biodiversity tend to endure extreme conditions and recover more readily from disturbances like droughts and floods.
- Greater biodiversity is linked to improved quantity, quality reliability and duration of pollination, which, for example, is particularly important for growing crops like canola.
- The increased levels of soil biodiversity that result from reduced tillage are linked to increased soil fertility, nutrient cycling and storage, greater crop yields, and long-term soil productivity.
- Greater biodiversity contributes to increased resistance of production systems to invasion by disease, weed and insect pests. For example, studies have shown that birds are capable of suppressing insect populations, at least at medium to low infestation levels. In prairie environments, birds have been shown to effectively control grasshoppers. Similarly, studies have shown that the greater the diversity of beetles, parasitic wasps and spiders in a farm landscape, the lower the incidence of insect pest outbreaks.
- Living organisms are the source of all livestock, all crops, all pollinators of crops, all biological control agents of pests, many pesticides and many pharmaceuticals. Retaining farm-scale biodiversity keeps options open for future benefits that are not yet discovered or realized.

Biodiversity is like
money in the bank
for your farm or ranch.



Biodiversity and pollination services
Reduction of insect pollinators results in reduced pollination services and lower crop yields. One example is the reduction in Manitoba of alfalfa seed production from 1000 kg/ha to 150 kg/ha as field size increased and wild bee habitat was removed during the 1940s and early 1950s.

While some species of birds can be pests to agricultural crops, most are not. In rangeland habitats, maintenance of populations of insect-eating birds, like this mountain bluebird, in combination with good management, can prevent grasshopper outbreaks.



Robberflies are found in native pastures in the drier regions of southern and central Alberta. Adults feed on a variety of pest species such as grasshoppers and hornets. The larvae live in the soil and decaying organic material where they prey on other insects and spiders.

Biodiversity and the Bigger Picture

The link between biodiversity and agriculture is becoming a topic of global interest, debate and research. There is a growing worldwide awareness and concern about agriculturally induced, broad-scale decline of ecosystems and their biodiversity. Reductions in biodiversity signal concerns related to the loss of existing economic, environmental and social benefits, as well as the loss of opportunities for future benefits that we aren't currently even aware of including resilience to the potential impacts of global climate change.

Such concerns exist for Canada, including the prairies. According to studies done for the World Wildlife Fund, little of the short-grass prairie in Canada is intact, and there are few major intact habitat blocks remaining of the northern mixed-grass prairie. They also report that little of the aspen parkland remains in North America. Although the biodiversity value of the prairie grasslands remains high, this ecosystem hosts disproportionately high numbers of plant and animal species showing long-term population declines.

Healthy, working agricultural landscapes are key to stopping these declines. Restoring biodiversity is a complex, gradual process, but it is achievable and provides increasing rewards along the way.

Many songbirds thrive in healthy grassland areas. Species such as the Sprague's Pipit increase in numbers in larger unfragmented grassland areas.

Sprague's Pipit: Predicted Occurrence in Grassland Areas

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Your Actions Make a Difference

Managing for increased biodiversity on your farm or ranch can provide benefits to not only biodiversity but also to the long term sustainability of your most important resource: your land.

Farmers and ranchers across Canada are taking action to conserve biodiversity. Many producers are using agricultural practices that protect soil, water and air quality, which at the same time help to maintain biodiversity as well. Some producers are also using practices specifically aimed at enhancing biodiversity. And groups of producers are working together to provide networks of bush, grasslands, wetlands and other habitats across the landscape. These actions are rewarding producers with ecosystem benefits, like pollination, insect and disease control, and resilience to the impacts of droughts and floods.

By following the principles set out in this guide, you'll help to conserve biodiversity and benefit from what increased biodiversity brings to your land.

Change with care

When you change a practice, unexpected consequences may sometimes occur. For example, planting a shelterbelt or erecting a perch for raptors (birds of prey) near burrowing owl habitat can increase predation by hawks on the owls. Some changes may also have the potential to bring pest birds, mammals, insects or diseases onto your land. The risk of negative impacts appears to be greater where landscape simplification is greatest (i.e., in areas with large monoculture fields).

Through careful planning, implementation and monitoring of a new practice, these risks can be reduced. Advice from experienced wildlife specialists can help you to make positive changes.

Conserving Biodiversity on Your Land: Principles and Actions

Biodiversity conservation on your farm or ranch simply means doing things that conserve the variety of living things and the interactions between them.

What you can do to conserve biodiversity depends mainly on the natural characteristics of your land and the surrounding lands, and on the type of agricultural operation you have and your approach to production. Therefore this section provides six general principles and their corresponding actions that you can adapt and apply to your own situation.

Understanding the six principles and their actions will help you gauge what you're already doing to conserve biodiversity and what other things you might consider doing. These principles and actions reinforce the fact that managing for healthy, productive farmland and ranchland conserves biodiversity.

Principle 1. Soil is the Foundation of Healthy Ecosystems

Soil is a world teeming with life. Living in the soil are plant roots, bacteria, fungi, algae, protozoa, mites, nematodes, worms, ants, maggots and other insects, and larger animals. The number of living organisms belowground is often far greater than that aboveground.

Soil provides a base on which plants can grow and within which animals can live and water is stored. As well, the soil and the life within it break down organic matter and cycle nutrients back into forms that plants can use. Fungi, bacteria and other microorganisms use the carbon, nitrogen and other nutrients in organic matter. Microscopic soil organisms feed on organic matter, fungi and each other. Together, the results of these activities stabilize soil aggregates, build better soil habitat and improve soil structure, tilth and productivity. All aboveground life forms depend on this foundation.

No-till cropping,
like this pea crop seeded into stubble,
greatly reduces soil disturbance and increases
soil biodiversity compared with conventional tillage systems.

What you can do:

Throughout your farm or ranch

- Maintain perennial cover on as much of your land as possible.
- Maintain uncultivated fencerows, native grasslands, bush and riparian buffer strips.

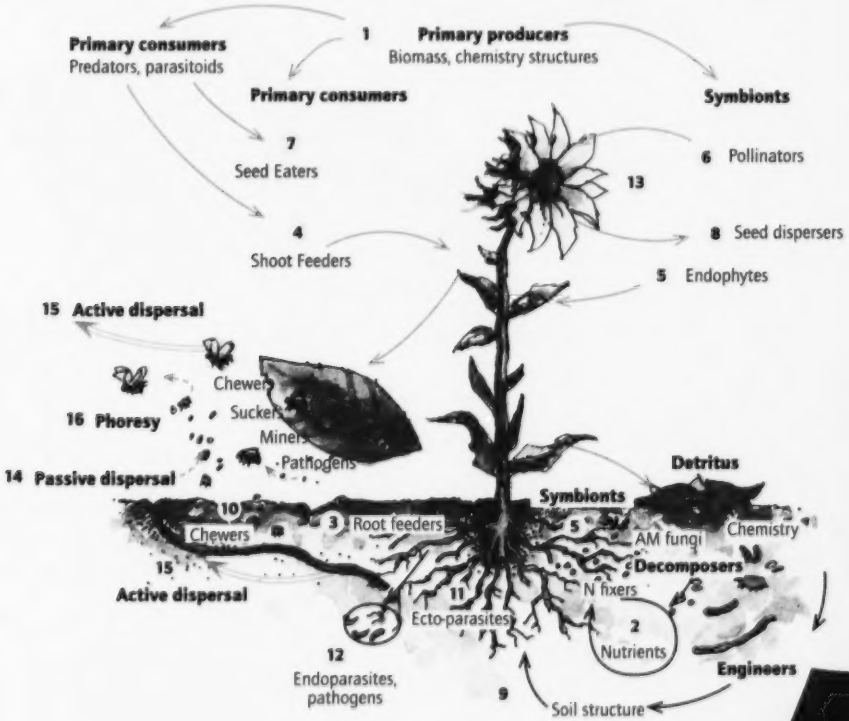
Grazed areas and hayland

- Balance forage demand with supply so that sufficient litter remains to maintain forage and range health, conserve moisture, and to protect the soil from erosion and organic matter loss.
- Learn about the specific characteristics of your riparian pastures through a riparian health assessment, and then graze those pastures at appropriate times to maintain or improve the structure and function of the streambank plant community.

Cropped areas

- Minimize soil disturbance by reducing or eliminating tillage.
- Maintain crop and crop residue cover on the soil at all times by using such practices as growing cover crops and minimizing tillage.
- Use diverse crop rotations (annuals, winter annuals, perennials) to encourage a diverse community of soil organisms.
- Manage nutrients to minimize disruption of the soil ecosystem by applying only enough fertilizer to replace the nutrients harvested with the crop, or by using composted or green manure.
- Minimize the use of agro-chemicals, especially pesticides, because they may affect the functioning of the soil ecosystem.

Aboveground and belowground biodiversity are interdependent. Aboveground plants (1) directly support primary consumers – seed eaters (7), shoot and root feeders (3, 4, 10, 11, 12) and fungi associated with roots (5) – and depend on pollinators (6), seed dispersers (8) and nutrient cycling (2). Seed dispersal can be active (flying, walking, crawling, burrowing) (15) or passive (by air, water or accidental carrying) (14, 16). Nutrient cycling is aided by decomposers like fungi and soil engineers like earthworms.



Principle 2. Native Areas are Biodiversity 'Storehouses'

Plants and animals evolve over time in response to the physical and biological characteristics of the area where they live. These include: soils; climate and weather patterns (e.g. timing of rainfall, drought, frost); and interactions with other species. Native species and communities are those that occur in the region in which they evolved. They possess certain traits that make them uniquely adapted to local conditions.

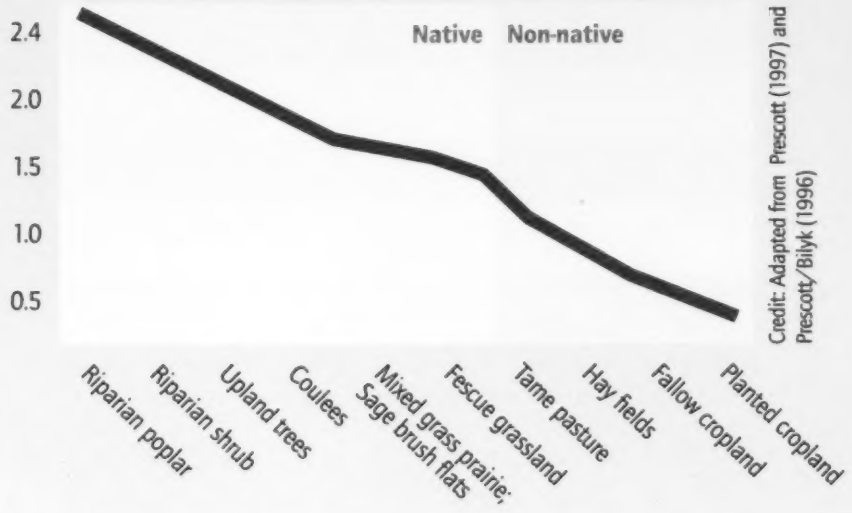
These unique traits can be highly valuable to both agriculture and the general public. For example, well-managed native grasslands have been shown to be more drought-resistant than tame pastures.

Decisions to conserve native habitat, such as leaving fencerows wild, can dramatically increase biodiversity. At the same time, these habitats can support beneficial organisms and ecological processes. Studies show that bird populations are generally larger and more diverse in wide versus narrow fencerow strips, in undisturbed versus disturbed (e.g., grazed) fencerows, in treed versus grass fencerows, and in riparian versus non-riparian areas.

Other studies have shown that, especially in low-input agriculture systems, locally adapted varieties often produce higher yields or are more resistant to pests than varieties bred for high performance under optimal conditions. At the same time, native areas are home to many unique plant and animal species. Large, intact native areas are also valued for their recreational, cultural and spiritual values.

Conserving native areas is vital because they have the highest levels of biodiversity. If native areas become increasingly scarce in a region, the importance of each native grassland, bush and wetland remnant becomes that much greater (see Principle 6).

Bird Biodiversity Values: Prairie and Modified Habitats



Credit: Adapted from Prescott (1997) and Prescott/Bilyk (1996)

Why keep it native?
Native areas have the highest levels of biodiversity.

What you can do:

Throughout your farm and ranch

- Maintain native grasslands, bush, riparian areas, wetlands and uncultivated fencerows.
- Conduct a biodiversity assessment to find out which species are present on your land.
- Manage native areas as a valued resource, including consideration for sensitive species, by working with local conservation agencies.
- Wherever possible, conserve locally-adapted native plant species and their seeds.
- Wherever possible, restore grasslands, bush, riparian areas and wetlands, and use native species, especially locally adapted native species, for these restoration activities.

Grazed areas

- Graze native grasses later in the season to take advantage of their adaptation to late season use. This will also allow ground nesting birds and waterfowl to complete their spring to early summer nesting without disturbance.
- Manage grazing timing and intensity in native pastures so native species are able to set seed.
- Use tame pasture or annual forages for spring grazing to delay grazing of native grasses.
- Complete a range health assessment of your native and tame pastures to provide a snapshot in time of the overall health of your grazed areas and to alert you to management issues and problems so that management changes can be made.
- Use carefully timed grazing to control invasive species. For example, to control the spread of Canada thistle, grazing should be timed just before budding to weaken plants and prevent them from going to seed.

Riparian zones support remarkably high numbers of native wildlife compared to the rest of the landscape. Restoring and carefully managing these zones contribute greatly to biodiversity, as well as improving water filtration, flood protection and groundwater recharge.

Principle 3. Timing and Intensity of Use Influence Biodiversity

Agricultural production systems that support the most biodiversity are those that mimic the area's natural patterns of disturbance (e.g., fire, grazing, flooding). You can mimic these patterns by managing the intensity and timing of agricultural use.

Intensity in agriculture refers to the relative level of inputs used for every unit of production. Intensive agriculture uses high levels of inputs per unit of production. In grazing, intensity refers to the number of animals in a given area times the duration of grazing. In cropping systems, intensity refers to the amounts of such inputs as fertilizers, pesticides, fuel and labour. Generally, higher intensity farming and ranching means greater disturbance to the environment (e.g., more tillage, grazing, trampling) and higher levels of man-made substitutions of ecosystem functions (e.g., nutrient cycling, pest and disease control).

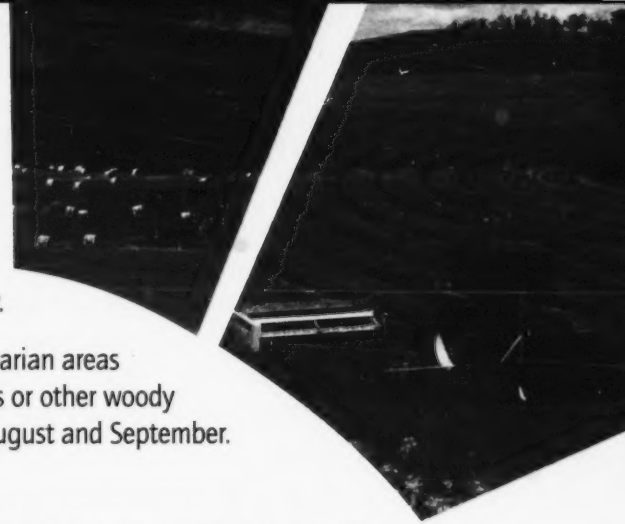
Timing of use is important to both plant and animal species. The timing of critical periods varies by species, so it is important to become familiar with the types and timing of sensitive periods for the species in your area. Generally, wildlife are most sensitive to disturbance when they are involved in breeding activities, especially rearing their young – nesting, denning, calving, spawning. Many native plants thrive when rested during the spring.

If a pasture is not given enough rest, livestock will repeatedly graze favoured plants, and soon those plants will be eliminated from the pasture. Without rest during the growing season, plants don't have enough time to rebuild roots and store energy. Without stored energy, spring growth is stunted and plants have little resilience against drought and disease.

What you can do:

Grazed areas

- Minimize grazing of native areas during the spring.
- Manage grazing to ensure sufficient native plants are allowed to set seed to maintain viable populations.
- Alter the entry date of livestock each year in pastures (i.e., first pasture entered is different each year).
- Develop a grazing plan that makes the most of your various pasture resources (native, tame, annuals, perennials) with flexibility in timing and intensity of use.
- Provide adequate rest periods for pastures during the growing season (also called effective rest).
- Use fencing and locate watering sites, salt/mineral and supplemental feed to control grazing intensity on native areas and create a diverse plant community with different types, ages and sizes.
- Avoid overgrazing forested pastures and manage cattle so that shrubs are conserved.
- Complete a range health assessment of your native and tame pastures to provide a snapshot in time of the overall health of your grazed areas and to alert you to management issues and problems so that management changes can be made.
- Complete a riparian health assessment of your riparian pastures to understand which areas to monitor as a guide for adjusting stocking rates and grazing duration in those pastures.
- Implement a riparian grazing management strategy that will achieve the ecological goals of the riparian area. For example, use grazing timing to maintain or improve the structure and function of the streambank plant community.
- Avoid grazing riparian areas that have willows or other woody species during August and September.



Hayland

- Defer haying until after July 15 to minimize wildlife disturbance, injury and death.
- Use a flushing bar when haying, especially if you must hay before July 15.
- Change your haying pattern to allow an escape route for wildlife.

Cropped areas

- Apply appropriate nutrients to meet crop needs.
- Use low disturbance seeding practices.
- Leave stubble standing.
- Grow winter annuals to minimize field equipment activity in the spring.
- Minimize field passes during the year.
- Minimize use of chemical pesticides; use biological and cultural methods to controls pests.

Hay fields should be mowed from the center outward to allow wildlife to escape to adjacent habitat.

Principle 4. Variety is the Spice of Life... and Diversity

Biodiversity is a major driver of ecosystem processes, right up there with climate, nutrient supplies and disturbance. Higher levels of biodiversity generally lead to higher productivity and year-to-year stability in production, as well as increased ecosystem benefits, such as pollination, insect pest control and disease resistance. So, high levels of biodiversity, in all its forms, generally enhance ecosystem functioning.

Healthy farmlands and ranchlands are characterized by high levels of plant and animal diversity. They include the full array of landscape types and plant communities typical of their area (like aspen bluffs, sloughs, wet meadows, fescue-dominated grasslands, etc.). They have: large areas of native vegetation; minimal areas with bare soil or few bare soil days; minimal soil erosion; wildlife corridors and large blocks of perennial cover; few weed problems; productive plant communities; and appropriate types and levels of disturbances, such as grazing, flooding, drought, erosion, or decomposition, to maintain ecosystem functions.

Encourage and maintain diversity wherever you can. Some examples (from left): a diversity of plant and animals species in a riparian area, planting legume crops in rotation, multi-species planted in forage crops, growing winter wheat, and grazing a mixture of livestock types on pasture.

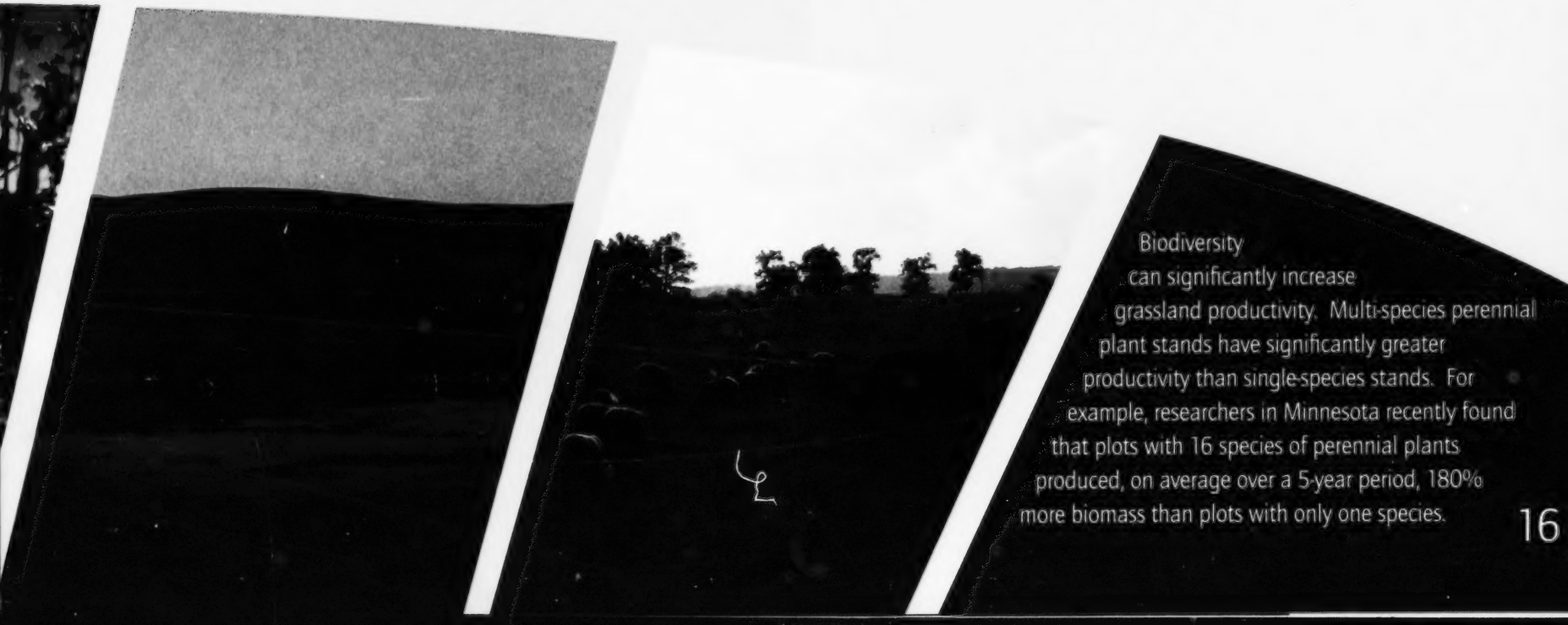
What you can do:

Grazed areas and hayland

- Graze uplands and riparian areas to create/maintain diverse plant communities of different ages and varying heights. For example, in any given year, plan your grazing with the idea of having used a full range of grazing intensities, from heavily grazed to lightly grazed, with the majority moderately grazed. This variety of grazing intensities increases the diversity within your pastures by maintaining a broad range of plant communities and types.
- Plant pastures and hayland with multiple species, using forage species adapted to your area.
- When possible, use more than one livestock type for grazing a pasture.

Cropped areas

- Diversify your crop rotation by including fall-seeded, spring-seeded and perennial crops.
- Diversify your crop rotation by adding legumes, like peas and beans.
- Consider companion cropping or strip cropping.
- Reduce the size of your fields.
- Where appropriate to the region, plant shelterbelts with multiple species, including fruit and nut trees and shrubs.



Biodiversity can significantly increase grassland productivity. Multi-species perennial plant stands have significantly greater productivity than single-species stands. For example, researchers in Minnesota recently found that plots with 16 species of perennial plants produced, on average over a 5-year period, 180% more biomass than plots with only one species.

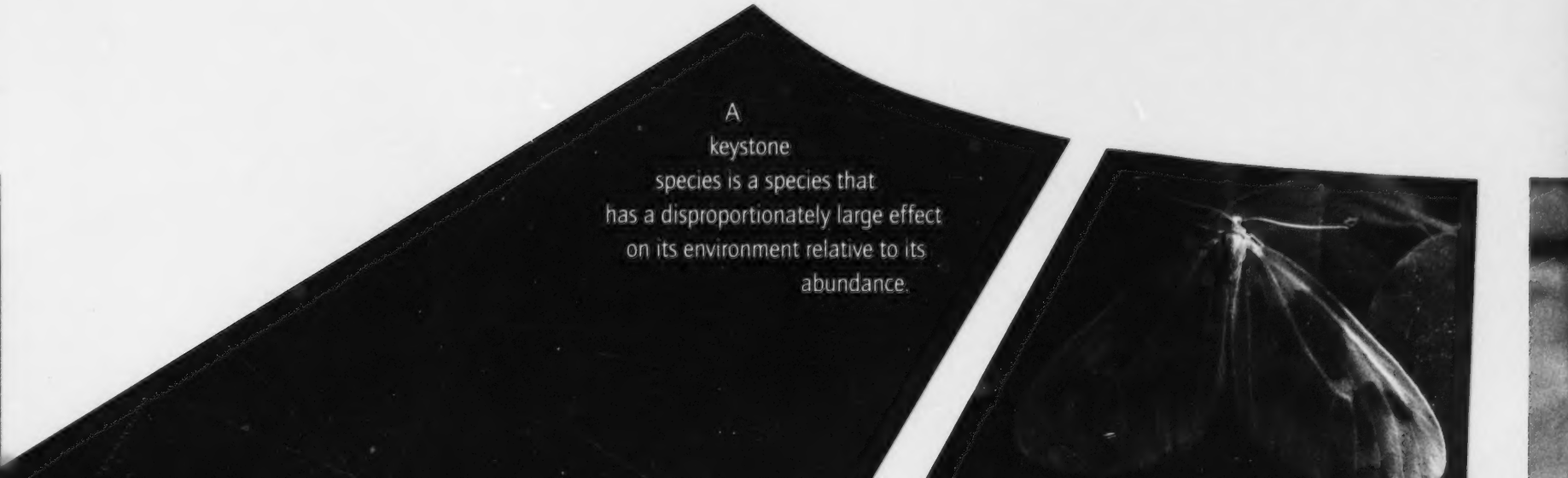
Principle 5. Not All Things Are Ecologically Equal

Not all species should be given equal weight when adjusting your practices to conserve biodiversity. For example, the gain of a pheasant or a hayfield does not offset the loss of a burrowing owl or a wetland.

A keystone species is a species that has a disproportionately large effect on its environment relative to its abundance.

If trade-offs are necessary, it is more important to conserve: species and communities that are uncommon, rare or endangered; keystone species; and species and communities that are especially helpful in enhancing productivity and minimizing the need for purchased inputs (like pesticides, inorganic fertilizers, fuel, medicines).

It is less important to conserve species like European starlings and house sparrows that thrive in disturbed and fragmented landscapes. Such species are often common and contribute little to or even detract from the health of the overall landscape.

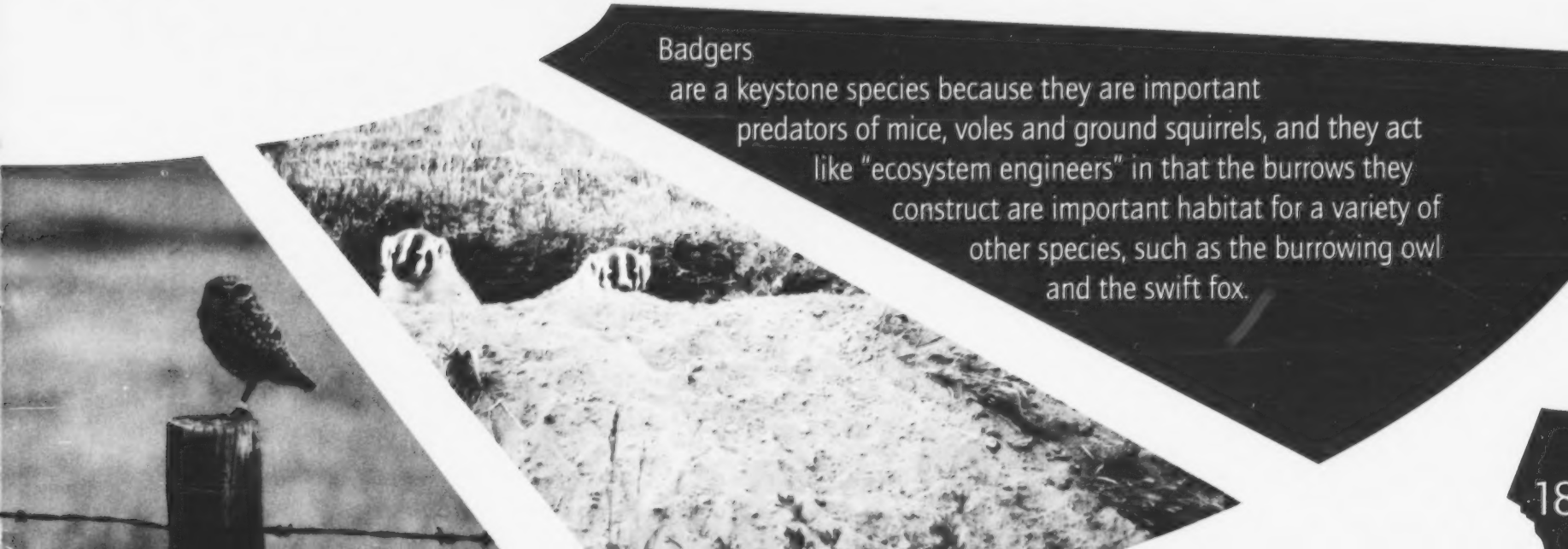


What you can do:

Landscape

- Identify important native and keystone species on your farm or ranch, as well as those that are unnaturally abundant.
- With the help of specialists, conduct a biodiversity assessment on your property.
- Get assistance in determining specific ways you can foster desirable species and discourage undesirable ones.
- Control invasive non-native weeds.

Harness the services of beneficial predators like green lacewings. Green lacewings lay eggs on stalks that hang from the bottom of leaves. The larvae hatch in a few days. The larvae are predatory and are sometimes called "aphid lions" because they eat so many aphids. They also eat caterpillars, butterfly eggs, small beetles, scale insects, leafhoppers, thrips, small flies, mites, and other insects and eggs. After transforming into pupae and then adults, lacewings become effective pollinators. Green lacewings live in fields, gardens, and along forest edges. They are readily identifiable by the striking venation of their wings.



Badgers are a keystone species because they are important predators of mice, voles and ground squirrels, and they act like "ecosystem engineers" in that the burrows they construct are important habitat for a variety of other species, such as the burrowing owl and the swift fox.

Principle 6.
Biodiversity Conservation Increases with Community Cooperation

Biodiversity conservation is most effective when it's coordinated at the community scale, with many individual landowners working together toward common goals. This is because many wildlife species require large areas to meet all of their life cycle needs and because important habitat areas, like rivers, creeks, lakes and wildlife travel corridors, often cut across several or many properties. By linking your actions to larger-scaled conservation plans, you can increase the effectiveness of your own actions, relate your actions to those of your neighbours, and contribute most meaningfully to the broader goals.

What you can do:

Landscape

- Work with your neighbours in your community to identify and share biodiversity goals, and to develop a plan and take action to achieve those goals:
    - learn about the relative importance of local species and habitats in the context of the overall landscape;
    - maintain or restore larger blocks of native grasslands and bush. This will allow your land to retain species that are dependent on larger areas of intact habitat (eg. owls, many grassland birds);
    - maintain or restore waterways and waterbodies, and their riparian areas;
    - identify and maintain wildlife travel corridors. Impediments to wildlife movement, such as poorly designed fences, should either be removed or improved to allow for easier wildlife movement;
    - identify and maintain unique wildlife habitats (e.g. nesting, feeding, wintering and denning areas); and
    - identify and maintain areas that support pollinating insects, such as bees, wasps and beetles.
- Work with natural resource management specialists to identify the key actions you could take to contribute to healthy, functioning landscapes and watersheds.

If managed as one component of a larger landscape, on-farm habitat corridors can help to allow the safe passage of wildlife across the landscape between larger habitat blocks.

Next Steps

Armed with the principles outlined in this guide and with some financial/technical assistance from the agencies listed in the next section, you are ready to take the next steps toward biodiversity conservation. The best way to accomplish your biodiversity goals is to develop and implement a biodiversity conservation plan that is integrated with your overall farm or ranch management plan.

The process has four main steps:

1. Identify and assess current habitat and biodiversity
- Identify and map ecologically important areas on and adjacent to your farm or ranch.
- Conduct a biodiversity assessment to establish a baseline against which future changes can be compared. Without this baseline, it will be difficult to determine whether positive changes have resulted from your actions.
- Identify land management practices that may be influencing biodiversity such as: fertilizer practices, grazing system, harvest practices, timing and frequency of practices, crop rotations, management of problem wildlife, management of invasive species, etc.
- Evaluate the impact of past and current land use and management practices on the biodiversity of each ecologically important area.

2. Identify and assess biodiversity maintenance and enhancement options
- Establish biodiversity goals that are unique to your farm or ranch.
- Identify various options for enhancing habitat availability and biodiversity on your farm or ranch.
- Estimate the effects of each option on ecologically important areas and on agricultural productivity and sustainability.

3. Develop your biodiversity maintenance and enhancement plan
- Identify the most promising biodiversity enhancement options.
- Describe management adjustments required for implementation.
- Develop an implementation timetable, from initial field testing of ideas to eventual full implementation.
- Describe the monitoring and evaluation process, including how you'll measure progress and success.

4. Implement actions and monitor effects
- Implement the actions in the plan.
- Monitor and evaluate the effects of each action.
- Adjust and fine-tune the actions to make sure that the intended outcomes are being achieved.

Resources

Agencies

The following agencies provide technical and/or financial assistance to Alberta farmers and ranchers for actions that enhance biodiversity in agricultural areas.

Agriculture and Agri-Food Canada
Prairie Farm Rehabilitation Administration (PFRA)
Website: www.agr.gc.ca/pfra/alberta_e.htm

Alberta Agriculture and Food
Ag-Info Centre: 310-FARM (3276)
Website: www.agric.gov.ab.ca

Alberta Conservation Association
Website: www.ab-conservation.com/

Alberta Fish and Game Association
Website: www.afga.org

Alberta Stewardship Network
Website: www.ab.stewardshipcanada.ca

Alberta Sustainable Resource Development
Fish and Wildlife Division
Website: www.srd.gov.ab.ca/fw

Alberta Sustainable Resource Development
Public Lands Division
Website: www.srd.gov.ab.ca/land/

Cows and Fish
Website: www.cowsandfish.org

Ducks Unlimited Canada
Website: www.ducks.ca

Environment Canada
Website: www.mb.ec.gc.ca/index.en.html

Federation of Alberta Naturalists
Website: www.fanweb.ca

Land Stewardship Centre of Canada
Website: www.landstewardship.org

Nature Conservancy of Canada
Website: www.natureconservancy.ca

Woodlot Association of Alberta
Website: www.woodlot.org

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Page 2 Barley field and farmer
Courtesy of Alberta Agriculture and Food (AF)

Page 4 Milk River Ridge Grasslands
Courtesy of Lois Gilchrist

Page 6 Bee on alfalfa flower,
Courtesy of Doug Friebel

Robberfly feeding on hornet.
Courtesy of Doug Macaulay

Mountain Bluebird
Courtesy of PFRA/AAFC

Page 8 Burrowing Owls
Courtesy of PFRA/AAFC

Hawk Platform
Courtesy of George Stalker

Page 9 Peas direct seeding into canola stubble
Courtesy of Rick Taillieu

Page 12 Treed area
Courtesy of Doug Macaulay

Riparian area
Courtesy of Diana Rung

Page 13 Cattle grazing
Courtesy of Duane McCartney

Page 14 Hay bales in the foothills
Courtesy of Darwin Chambers

Flushing bar
Courtesy of Ducks Unlimited Canada

Page 15-16 Riparian area,
Courtesy of Laura Ung

Peas direct seeded into stubble
Courtesy of Peter Gamache

Multi-species pasture mixes
Courtesy of Deb Webster

Winter Wheat
Courtesy of Ducks Unlimited Canada

Mixture of livestock types on pasture
Courtesy of USDA

Page 17-18 Lacewing
Courtesy of Doug Macaulay

Badger and burrowing owl
Courtesy of Lindsay Tomyn

Page 19 Forest understory
Courtesy of David Fairless

Page 19-20 Two people looking at a map
Courtesy of Ducks Unlimited Canada

Wetland with farmyard in background
Courtesy of Ducks Unlimited Canada

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Alberta

AESA
Alberta Environmentally Sustainable Agriculture Program

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

PFRA ARAP

Ducks Unlimited Canada
CANADA'S CONSERVATION COMPANY